Patient-focused care over time: Issues related to measurement, prevalence, and strategies for improvement among patient populations

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Key Implications for Decision Makers

Measuring continuity of primary care with administrative data

- Administrative data can be used to measure continuity in primary care by examining the degree to which a patient’s care is concentrated with certain providers.
- We found that easily constructed and understood measures of continuity performed as well as or better than more complex measures.
- Selection of measures should be based on the ease of calculation and interpretability. Our work here suggests that some indices are best suited for routine reporting while others are most appropriate for research uses.

Continuity provided by primary care physicians and large practice groups in B.C.

- Existing administrative databases may not routinely provide accurate information on which physicians are involved in primary care group practices.
- In 1996/97, fewer than one-quarter of B.C.’s primary care physicians practiced in large groups (four or more full time physicians). Large-group practices are more common in rural and suburban areas than in the large metropolitan areas.
- Adult patients had relatively high continuity of primary care in B.C. over the period 1994-96. However, children had much lower continuity, compared with adults or seniors.
- Most large clinics did not appear to “share” a practice list; instead, patients generally saw the same physician. Even patients of large group practices saw a single physician for an average 70 percent of their primary care.
- In the average large clinic, about 50 percent of all patients receive most of their care from that clinic.
- Continuity of a personal physician had a significant but small effect on the likelihood of future hospitalization (higher continuity was associated with a lower probability of hospitalization in the subsequent year). Using site of care rather than an individual primary care provider did not increase the ability to predict hospitalization in the subsequent period.

Continuity of primary care in patients with severe and persistent mental illness

- Administrative databases (at least in B.C.) are not well-suited to investigations of the extent and effects of continuity of primary care in these populations. Unless those gaps can be addressed, or better ways found to identify the relevant patient population and construct continuity measures for them using available data, attempts to study continuity of care in this population using such databases is not recommended.

Continuity of primary care in patients with workplace injuries

- Individuals who report workplace injuries experience lower levels of continuity both before and after their injury, suggesting there may be room for changing patterns of health service use, which could, potentially, affect both propensity for and recovery from such injuries.

Observations on working with decision making partners

- Maintenance of ongoing interest by decisions makers in a longer term program of research can be very challenging, especially when there is a change in staffing and/or organization within the decision maker partner (which is common).
- As a general rule, decision makers are more interested in applicable results than they are in the research process, particularly when the research is concentrated on the development of methods, as much of this program of research was.
**Executive Summary**

Continuity of care has been identified as critical to effective primary healthcare. Sustained, continuous relationships between patients and their providers are arguably key to improving the outcomes of primary healthcare. However, there has been little systematic quantitative research focused on the impact of different levels of continuity of care, in a Canadian context, on important process and outcome variables. Key to such work is robust, valid measures of continuity of care, which are both easily computed and easily applied and interpreted.

This research program investigated ways of measuring continuity in the context of primary care. The program was divided into four separate research projects that were designed to address the following: identify the best measures of relational continuity in primary care; measure continuity for the population of British Columbia; and measure the impact of continuity of care on health outcomes. Once the best measures for continuity of primary care were identified, they were applied to three patient populations: (1) general primary care practice populations; (2) persons with severe and persistent mental health disorders; and (3) persons with workplace related injuries.

Data for this program came from the B.C. Linked Health Database, a population-based research database that contains a range of healthcare data for all people registered in the provincial healthcare system. The key advantage to using these data for this program is that they provide a population based perspective.

**Project A — Measuring continuity of primary care with administrative data**

In this project, we compared self report of having a regular doctor (from the National Population Health Survey) with six different measures of relational continuity constructed with administrative records of visits to physicians. Measures were constructed for persons who had three or more visits over one or two years. The different measures were compared and those measures that performed best were constructed for a five percent random sample of B.C. residents. The measures were constructed with three different configurations of visit data: primary care visits only; primary care visits and specialist visits; and primary care visits with specialist visits attributed back to the referring physician. The measures were also evaluated for their ability to predict hospitalization.

The way the measures were operationalized influenced their performance. In general, the measures constructed over a two year data window outperformed those constructed over only one year, both in their concurrence with self report of a regular source of care and in their prediction of future hospitalizations.
Similarly, the measures constructed with primary care visits with specialist visits referrals attributed back to the originating physician significantly outperformed those that included primary care visits only. This finding is consistent with the notion that specialty and primary care visits are “connected” (and thus continuous) through the process of referral.

**Project B — Comparing continuity for primary care physicians and practices**

This project focused on the question of whether, for patients who receive most of their care from physicians in group practices, calculating continuity on the basis of only one physician might be unduly restrictive and not representative of the continuous integrated care that they actually receive. The project focused on patients of practices with four or more full time-equivalent physicians. The patient populations for each practice were divided into a core group who made three or more visits in the study period and who made most of their visits to that practice, and others. Continuity measures were calculated for the core group of patients, based on physician level and practice level definitions. As with Project A, hospitalization was the main outcome measure.

About 30 percent of B.C. primary care physicians were found to practice within a large group. Large groups were the predominant practice organizations outside metropolitan Vancouver and Victoria. Thus, most B.C. physicians who practice in these settings were not affiliated with a large group. The distributions of physician continuity measures were similar to those found in Project A. As we expected, measures based on practice definitions were higher — patients got seemingly more continuous care if it was measured based on the practice rather than the individual physician. Physician level continuity measures (constructed with specialist referrals re attributed to the general practitioner) were statistically significant predictors of subsequent period hospitalization, while practice-level measures added no additional explanatory power.

This latter finding reflects the fact that physician based continuity was relatively high in these large groups; on average patients making at least three visits during the year saw a single physician for about three-quarters of them. Thus, most large practices do not appear to share common patient “lists.”

**Project C — Continuity of primary care in mental health**

In this project, we attempted to measure continuity of primary care for persons with severe and persistent mental health conditions. Because of large gaps in the available administrative data for this population, several data sources — hospital records, pharmaceutical payments, a mental health service database, and
physician fee for service records — had to be combined to define the cohort. Continuity measures were constructed using physician payment records as well as records of pharmaceutical prescriptions, treating each prescription as a physician “visit.” The outcome measures were hospitalization, number of hospitalizations, and death in the subsequent period.

Because of gaps in the physician payments data, we analyzed pharmaceutical prescription data as a proxy source. In a sub study using a population for which we had relatively complete data from both sources, however, we found poor agreement — the pharmaceutical based measures tended to produce continuity measures considerably higher than those based on the physician payment data. Not surprisingly, then, using pharmaceutical based measures of continuity for this population produced results suggesting greater continuity of primary care than that found in Projects A and B.

In general the continuity measures were poor predictors of all of the outcome measures. Only continuity measures for those on income assistance with mental health conditions were significant.

The primary conclusion from this project was that existing administrative data, at least in B.C. for this period, provide an inadequate source of information for assessing continuity of primary care for patients with severe and persistent mental health conditions. Some combination of more comprehensive data and more nuanced continuity measures based on what data exist will be required if further progress is to be made. This should be a high priority for the research community, given the considerable potential impact (at least in theory and suggested by our limited results) of improved primary care continuity in this very difficult and costly population.

**Project D — Continuity of primary care in persons with workplace injuries**

This project compared continuity of care for people with workplace injuries to those without injuries, before and after an injury. Measures were constructed according to the methods developed in Project A. The population was identified using injury claims data from the Workers’ Compensation Board. Continuity of care was slightly lower for those who had a workplace injury than for those who did not report an injury, both before and after the injury.
Context

Policy Problem Addressed

The central objective of our medical care system is to maintain the health of Canadians and, when necessary, restore their health when beset by illness or injury, as efficiently as possible. Several recent national reports have suggested that an improved primary care system is key to improving the performance of our healthcare system. One aspect of primary care highlighted in these recommendations as being key to an effective and efficient healthcare system, and in need of improvement in Canada, is continuity of primary care — a continuous relationship, sustained over time, between patients and their primary care providers. In Canada, general practitioners and family physicians have taken this role, but there is a push to integrate nurse practitioners and other providers into primary care teams.

Patients and primary care providers come to know each other in an environment of trust and to share responsibilities for goal setting and decision making regarding their health. In contrast to specialty care, this relationship is not oriented around singular health concerns but extends across the range and interaction of problems that patients may encounter over time. The focus of this research program was this continuous therapeutic relationship between patients and their primary care providers. We examined the extent to which these relationships appear to exist in British Columbia, how they are affected by patients seeing multiple physicians sharing the same practice, and the impact of these relationships on important healthcare outcomes. As primary care is reconfigured, it is vital for policy makers to understand if investments in sustaining these relationships over time will pay off.

Research Questions

The focus of this program of research was to investigate the following questions: “what are the optimal ways of measuring continuity in primary care using available administrative data;” “to what degree is continuity of primary care currently provided for residents of one large Canadian province;” and “how does continuity of primary care influence important health outcomes?” In addition to investigating different measurement approaches, we examined the concept of continuity of primary care in three patient populations representing a range of common situations where evidence had suggested that continuity in primary care might have important effects: (1) general primary care practice populations; (2) persons with severe and persistent mental health disorders; and (3) persons with workplace related injuries.
Past Research

Continuity of care is thought to be a critical aspect of healthcare, but there is a lack of consensus on how continuity is defined and measured, especially across healthcare domains. In general, the core notion of continuity is that patients experience their care as connected and coherent over time.7 There are three main types of continuity that support this “uninterrupted succession of events:” informational, management, and relational continuity. Informational continuity reflects the notion that details on past events are available and used to inform current care. Management continuity means that care is clinically consistent over time, that someone is managing the case, or that the management responsibility is efficiently and effectively transferred, and that as a result duplication of procedures and communications are kept to a minimum. Relational continuity means that ongoing patient provider relationships are nurtured in order to bridge healthcare events and create an expectation for future care. Relational continuity, one of the defining attributes of primary care (also referred to as longitudinality), is the type of continuity explored in this research program. In primary care, relational continuity refers to the existence of sustained relationships between patients and providers that cross health problems and reflect trust, mutual understanding, and effective communication built over time.7

Empirical evidence showing the benefits of continuity has been well-documented. Having a regular primary care provider with whom a patient concentrates his or her care has been associated with improved adherence to prescribed screening and treatment,9-12 better recognition of unidentified health problems,13, 14 better rates of recommended immunizations,15, 16 fewer acute care hospitalizations,17-20 lower use of emergency rooms,21-23 and improved patient satisfaction.24,25 Researchers have also found a general reduction in healthcare costs as continuity of care improves.26, 27

Contributions of current research

1. **Measurement/methods development**

- A variety of approaches to measuring continuity in primary care have been employed. A major objective of this program of research was to undertake ‘head to head’ comparisons of these alternative measures, in terms of reasonableness, robustness, and understandability, or face validity (for policy makers), and to compare measures based on administrative data with measures based on self report.
Another objective was to ascertain whether continuity of care, and the relationship between continuity and outcomes, differed depending on whether one used only primary care contacts, primary and specialist care contacts treated equally, specialist care contacts attributed back to referring primary care provider, and a group practice (where relevant) or the individual primary care provider, as the ‘source’ of that continuity.

2. Methods application

Following the methods development, a measure or measures were applied to explore the relationship between continuity and outcomes for three specific populations — a general primary care population, those suffering from severe mental illness, and those with workplace injuries.

Approach, Data Sources, Methods, & Results

This program of research was divided into four projects, all of which focused on continuity of primary care measured with administrative data routinely collected by provincial governments and healthcare facilities. The main advantages of these types of data are that they (a) are already collected and relatively inexpensive to apply; (b) provide population based perspectives rather than focusing on limited samples; and (c) can be linked with other health related data. However, there are limits to using administrative data to measure continuity in primary care settings. Administrative data are limited to examining patterns in the contacts that patients make with selected health professionals (mainly physicians). We assume that relational continuity (that is sustained relationships characterized by trust, mutual understanding, and expectations for future care) exists when patients concentrate their care with particular physicians or see the same physicians sequentially.7

The data used in this program of research include components of the B.C. Linked Health Database28, a population based and person oriented research database that has tracked a range of health-related data since the mid 1980s (including hospital separations abstracts, fee for service physician claims, mental health and continuing care encounters, and vital events records) for all persons registered with the provincial healthcare system. In the next section, we briefly summarize the objectives, methods, results, and interpretation for each of the projects. (In depth descriptions are provided in the attached appendix.)

Project A — Measuring Continuity of Primary Care with Administrative Data

This project grappled with the “how tos” and “best ways” of measuring primary care continuity using administrative data. The results of this project not only informed the subsequent projects, but are also of interest to decision makers charged with developing primary care performance reports.
Over the last 30 years, a variety of tools, geared to administrative data, have been developed to measure a patient’s propensity to visit the same provider: the ‘usual provider continuity’ index (UPC),29 the ‘continuity of care’ index (COC),30 the ‘known provider continuity’ index (K),31 the ‘likelihood of continuity index (LICON),12 the sequence of continuity’ index (SECON),32 the ‘likelihood of sequential continuity’ index (LISECON),32 and others.33,34 We have previously described the theoretical strengths and weaknesses of these measures in detail.7 All these measures assess the extent to which patients concentrate their physician care and/or see the same providers over a succession of visits. Each can be adapted to measure continuity at the group level. They differ substantially, however, in their ready interpretability, simplicity, data requirements, and other features.7

In addition to their mathematical properties, the performance of the measures may be affected by the manner in which they use the administrative data. Key decision points in their use include selecting the time window for the encounter data, the types of visits to include, and the care providers of interest.32 No standards exist to assist either researchers or healthcare administrators in making decisions among alternative approaches to measuring and reporting on continuity of care. The project aims were to (a) construct, examine, and compare the performance of selected measures using administrative data for a sample of B.C. residents; (b) examine and compare aspects of the concurrent and predictive validity of these measures; and (c) examine and compare performance using different time windows.

This project consisted of two sets of analyses using different databases. The first was directed at examining concurrent validity of the available measures using self report of having a “regular doctor” as the reference measure. Having a regular source of care is an alternative way of measuring continuity in primary care settings.35 The second was directed at examining their predictive validity using future hospitalization as the outcome of choice. Readers are referred to the appendix for detailed methods and results for both studies.

a) Comparing Administrative Measures with Self Reports of Having a “Regular” Doctor

Methods: The study population for this analysis included B.C. respondents to the 1994/95 National Population Health Survey who consented to have their data shared with their home provincial government and linked to utilization data (n=2,084). The data source included the survey question about having a regular source of care, linked to fee for service physician payment data for the two years prior to the survey. After collapsing the physician data into a primary care “visit” file, we constructed the UPC, COC, K, and SECON measures using data for two time windows: one year and two years prior to the survey date. We also constructed the LICON and LISECON measures, which adjust for the number of available physicians that one has the potential of visiting. The number of available physicians was ascertained by counting the number of full time primary care physicians working in an individual’s local health area.
Because care patterns cannot be reliably ascertained for those with less than three visits, we constructed these variables for those making three or more visits during the time frame. The analyses consisted of examining how often patients report having a regular source of care and the frequency distribution for each of the administrative data constructed measures, stratified by key variables. Because many patients saw only one physician for all of their care, we also categorized these measures into quintiles. Agreement between the indices was examined with weighted kappa statistics and the relationship with having a regular source of care was examined with logistic regression models.

Results: Most B.C. respondents to the survey reported having a “regular” physician (89.1 percent). Over the one and two year time windows, approximately 50 and 75 percent of these respondents also made three or more primary care visits, meaning that we could calculate continuity indices. While persons who made less than three visits were less likely to have reported having a regular source of care, about three-quarters of all the low-use respondents (less than three visits) also reported having a “regular” doctor. This finding suggests that many people retain an affiliation with a physician even though it may have been several years since they had contact. It also suggests that longer rather than shorter timeframes are needed to use administrative data effectively for analyses of changes in continuity of care.

All the continuity indices were skewed heavily towards one with a sizable proportion (20-30 percent) of individuals always seeing the same physician. We found high agreement among the UPC, COC, K, and SECON measures (divided into quartiles, weighted kappas 0.71-0.94). However, the LICON and LISECON measures were very sensitive to the approach taken to measuring the number of available GPs. Given that there was no unequivocal gold-standard approach to measuring available GPs, we dropped these two measures from the remaining analyses. For the UPC, COC, K, and SECON indices, we found only moderate agreement between the one year versus two year time windows (weighted kappas 0.63-0.66). Using multivariate logistic regression models to predict self report of a regular source of care, we found considerable concurrent validity for all four continuity indices. Overall, we found a statistically significant ‘dose-response’ relationship for each measure. In other words, stronger associations were found with increasing levels of continuity measured with administrative data. Again, there were few differences among the UPC, COC, K, and SECON indices, but the variables constructed over two years were more consistent with self report of regular source of care than the one year variables.

b) Predictive Validity of the Continuity Indices in Predicting Future Hospitalization

Methods: The study included a random five percent sample of B.C. residents registered with the provincial healthcare plan who made at least three primary care visits in 1995/96. We measured the COC,
UPC, K, and SECON over 1995/96* and acute care hospitalizations in 1996/97. Other research has suggested that hospitalization is a continuity sensitive outcome.7-20 Rather than focusing on different time windows, we constructed each index using three different data formulations: primary care visits only, primary care and specialty visits (treated independently), and primary care and specialty visits where specialty visits were attributed back to the originating referring physician. This latter method is based on the assumption that primary and specialty care visits are “connected” through the referral process. In the analyses, we first examined the agreement between the continuity indices (grouped into quintiles) for each data formulation (that is, primary care visits only, primary care with reattribution of referral visits, and primary care and specialty visits). We also looked at agreement between the data formulations for each index separately.

Multivariate logistic regression models were constructed to predict hospitalization in the following year using each continuity index and each data formulation as the independent variables. The odds ratios were adjusted for patient case mix and GP and specialist use.

**Results:** The distributions of the UPC, COC, K, and SECON indices in our sample of 60,475 B.C. residents were very similar to the distribution of responses to the regular source of care question in the National Population Health Survey sample; the measures were all skewed towards one, with about one-third of people seeing the same primary care physician consistently. In general, we found that the indices were higher when constructed using primary care visits only, compared to when specialist visits were added.

Also consistent with the National Population Health Survey, we found highest agreement between the indices (divided into quintiles) constructed based on primary care physician contacts only. Inter index agreement declined when specialty visits were added. For each index, there was poor to moderate agreement when the different data formulations were compared.

The multivariate models all performed reasonably well in predicting hospitalization the following year. The continuity indices, however, were not significant predictors of hospitalization (about 10 percent of the sample had a hospitalization) in the models that only looked at primary care visits. When specialist visits were included and attributed back to the originating GP, all the continuity measures achieved statistical significance in dose response relationships; that is, the higher the continuity score, the lower the likelihood of subsequent period hospitalization. Similar to the national survey, we found small differences among the indices’ predictive abilities.

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* We did not formulate the indices using two years of administrative data because the results from the first part of the project were not available when these analyses were commenced.
Implications: Taken together, both sets of analyses in this project inform how continuity of primary care should be measured with administrative utilization data. These findings are not only important to researchers but also to policy makers wanting to include such measures in health-system performance reports. We found substantial concurrent and prospective validity for four measures: the COC, UPC, K, and SECON. (The LICON and LISECON were not useful because we could not find a suitable way, using administrative data or any other convenient source of information, of measuring the number of physicians potentially available.) On the whole, each measure showed a dose-response relationship with (a) patient self report of having a “regular” physician (an alternative way of measuring continuity using survey data); and (b) case mix adjusted hospitalization in the following year. In both sets of analyses, we found that the performance across the four alternative continuity formulations differed only slightly. We believe the UPC or K index may be preferred by policy makers because they are easy to calculate, require minimal data, and are easily interpretable. For researchers, the UPC or the COC may be preferred because of their common use.

The methods by which these measures were operationalized from the utilization data did influence their performance. In general, the measures constructed over a two-year data window outperformed those constructed over only one year. Moreover, with only one year of data, we could only measure continuity for about 50 percent of people (those who made three or more visits), compared to 75 percent when a two year window was used. For future hospitalization, we found that when specialist visits and referrals attributed back to the originating physician were included, the indices significantly outperformed those that included primary care visits only. This finding is consistent with the notion that specialty and primary care visits are “connected” (and thus continuous) through the process of referral. Future research should compare performance among other continuity sensitive variables (including use of preventive services, recognition of undiagnosed problems, emergency room use, and patient satisfaction).

Project B — Comparing Continuity for Primary Care Physicians and Practices

This project was intended to examine whether relational continuity improves if the “usual source of care” is extended from an individual primary care physician to any primary care physician within an extended group practice; and whether continuity based on such an expanded concept is better able to predict future hospitalization. Group practices are commonplace but differ substantially in how physicians organize their patient care. At one extreme, some practices serve only as a mechanism to share resources and on call duties. At the other extreme, some practices have “shared lists” where patients are encouraged to see any physician within the practice. In addition, some group practices function as “walk in” clinics, providing non scheduled care.
In general, most Canadian research has examined the care delivered by individual physicians; relatively little has focused on the care patterns by physician groups. In one of the few such studies, Menec and colleagues found that practices varied considerably in the degree to which they delivered the majority of care to all the patients that they saw.\(^{39}\) Remarkably, despite policy reports recommending shifts towards “primary care teams,”\(^{40}\) there is remarkably little evidence about how physicians share care or the benefits and risks when a group becomes a patient’s “usual source of care.” One could hypothesize that the focus on groups might endanger the benefits that accrue from personal continuity or result in communication breakdowns between physicians. Alternatively, moving to teams could improve both access and comprehensiveness and avoid the problems of patients growing too dependent on particular providers.\(^{41}\)

The aims of this project were to (a) quantify physician and practice based continuity for patients of large primary care group practices in B.C.; (b) examine the differential impact of physician and practice-based continuity on the rates of hospitalization; and (c) develop a measure for classifying practices on the degree of “patient sharing” that occurs.

**Methods:** This project used four data sets for 1996/97 1998/99: patient and physician registration data, fee for service physician payments, and hospital separation abstracts (see appendix). Considerable energy went into combining and transforming these administrative data into an analytic file. We constructed the analytic file in four steps:

1. **Defining primary care practices in B.C. with the administrative data.**

Defining primary care practices in B.C. presented a major challenge. Unfortunately, no practice identifiers are available from the administrative data. While others have grouped physicians into “virtual” practices based on patterns of patient sharing,\(^{42}\) we took the approach of placing primary care physicians together if they shared the same office space. To group physicians based on office location, we triangulated three different sources of physician address data: the Ministry of Health payee addresses and group billing numbers; the College of Physicians and Surgeons of B.C. directory of licensed physicians; and the local telephone white pages. We began by electronically linking physicians who had similar billing addresses and then manually validating these groupings with the college and telephone directories. If the addresses differed, the college directory was taken as the “gold standard” (since physicians must provide accurate addresses to maintain licensure). We deemed physicians to be located in the same office space if they matched on town (or city), street or post office box number, postal code, and at least two of the following: clinic name, suite number, telephone number, and fax number.
2. Identifying large group practices and their patient populations

Once physicians were assigned to practices (solo or group), we calculated the total number of family physician/general practitioner full time equivalents based on percentiles of total payments from the provincial government in 1997/98. After summing the full-time equivalents, we separated practices into solo (one or fewer full-time equivalents), small group (two or three full-time equivalents), and large group practice sites (four or more full-time equivalents). We identified three patient populations for each practice: all patients who visited that practice at least once during the study year; the subset of these patients who were moderate or high users (three or more visits); and the practices’ “core” patients who had three or more visits overall and made the plurality of visits to that practice. This latter measure is based on the assumption that it is these “core” patients for whom a practice is most responsible.

3. Creating the physician and practice based continuity of care variables

We applied the COC and UPC measures developed in Project A for use in this project. (Because of the high concordance between the four measures, we dropped the K and the SECON variables from this analysis.) We calculated the indices over a two-year window (1995/96 1996/97) with two data definitions: in the first, we included primary care visits only, and in the second we included primary care and specialty visits, with the latter attributed back to the referring physician. For this project, we calculated both indices using two “provider” definitions: the individual physician and the aggregated group practice. For example, the provider based UPC reflects the proportion of all visits that were delivered by the physician with the highest number; the practice based measure reflects the proportion of visits delivered by the practice group with the highest number. These indices were calculated only for those patients making more than three visits overall and who received the plurality of their care at one of the large group practices.

4. Constructing other variables including hospitalization and case mix measures.

Hospitalization, our main outcome, was captured for the year following continuity measurement. The case mix and utilization variables included age, sex, income deciles, adjusted clinical groups, aggregated diagnosis groups, location of residence, and visit counts (primary and specialty care).

The analytic approach for the project included describing and comparing physician and practice based continuity for the total population, and stratified by health region and patient/practice groupings. We also used a series of stepped multivariable logistic regression models to examine the influence of physician and practice based continuity on the case mix adjusted likelihood of following year hospitalization.
Results: Using the three sources of address data, we were able to group approximately 30 percent of B.C.’s GPs into 183 large-group practices comprised of four or more GP full-time equivalents. A further 44 percent of GPs practiced in small groups; the rest (27 percent) practiced in solo practices. While overall GP supply was very unevenly distributed in favour of the major greater Vancouver and Victoria regions, we found the opposite pattern with regard to large-group practices. There were more large groups in B.C.’s rural and suburban health regions. Overall, we found that about half of all B.C. residents made at least one contact with a physician in one of these practices during 1997/98. However, the group practice size was very variable (mean patient count 11,531; SD 5,664), consistent with other research.43 We also found that about half of the persons visiting these primary care practices with some frequency (three or more visits) were not “core” patients of that practice, but rather “belonged” to some other practice populations.

The distributions of the UPC and COC measures constructed at the unit of the individual physician were, not surprisingly, similar to those found in project A. Overall, the average patient in B.C. (excluding low users) received the substantial majority (about 70 percent) of his or her primary care from the same GP. As expected, continuity improved when viewed from the perspective of the practice. The average patient of one of these large clinics received about 81 percent of his or her total care from one particular site. Thus for core patients of these practices, only a small minority of care was delivered outside the practice. We also found that seniors had much higher physician based continuity than did either adults younger than 65 or children. These age related differences were less pronounced for practice level continuity. Few differences were found by sex and income level. We found that patients with high illness burdens had slightly lower physician continuity compared to patients with low burdens (mean COC: 0.46 vs. 0.54). As with Project A, the physician level continuity variables were statistically significant, showing that lower levels of continuity are associated with increased odds of hospitalization. However, after accounting for case mix and utilization, the effects are small (odds ratios 1.03 1.09). The practice level continuity variables had a statistically significant effect on its own but were not much improved from the model containing physician level continuity. The large sample size provides such high power, however, that effects are likely of little practical consequence. All of the models accounted for a relatively low proportion of the variation in hospitalization.

Interpretation: This study took our research program in a new direction: examining whether continuity of care ‘improved’ when measured at the group-practice level, and whether group level measures were better able to predict future hospitalization. We expended much more effort than anticipated in defining physician practices using the available administrative data. While the group practice is the most common way that primary care is currently organized in the province, the available data do not permit easy
identification of various forms of “groups.” We believe that the addition of a practice identifier to the administrative data would greatly assist any evaluation of new primary care models.

One of the most important findings of this study was the fact that only a minority of primary care physicians in B.C. currently work in large group practices. As well, the distribution of large groups is highly skewed toward smaller population centres; they are rare in the greater Vancouver and Victoria areas. To move towards multidisciplinary practices that can provide 24-hour access \(^2\) would require a willingness on the part of physicians to coalesce, particularly in the large urban centres, either by physically joining or by developing practice based networks of care.

Another important finding of our report was that physician based continuity was relatively high in these large groups; on average, patients making at least three visits during the year saw a single physician for about three-quarters of them. Thus, most large practices do not appear to share common patient “lists;” this stands in marked contrast to findings in the U.K. \(^{36}\) and U.S. Medicaid populations. \(^{37}\) When patients of large groups did not see their regular physicians, we found that they were likely to opt to see another physician in the same office. Overall, the average core patient made more than four out of five of their total visits to the same practice site.

There are a number of (at least theoretical) benefits to receiving care at the same office: common office records promote better informational continuity, and patients of group practices might expect better management continuity. We did find, however, that not all practices appear to be the same in delivering continuity. The average large practice provided most care to only about half of all the patients they saw, and about one in 10 practices delivered the most care to only about one-third of patients who walked through their doors.

When examining continuity by age group, we found some sizable differences. Interestingly, the physician based COC index for children was about half what it was for B.C. seniors. In other words, parents are more likely to take their children to multiple physicians, whereas adults are more likely to concentrate their care with a single physician. The reasons underlying this difference are unclear. It may be because children’s health concerns are perceived as more urgent and parents prefer ready access, and attach less importance to continuity. Another possibility is that health conditions among children require fewer follow up visits to the same physician or are perceived to be less affected by continuity. More research is needed to understand the motivations behind care seeking by parents on behalf of children, and the implications of these patterns of care for primary care organization.
We also found that after comprehensively accounting for case mix and the number of physician visits, physician based continuity was only a weak predictor of hospitalization in the following year (odds ratio=1.09 comparing the lowest to the highest continuity quintiles). This is a much lower effect than that found by Mainous et al. among the Delaware Medicaid population. The attenuated effect in B.C. may relate to the relatively high physician continuity in the B.C. population compared to that analyzed in Medicaid (54 percent of the Maryland population had a UPC of 0.5 or lower). Alternatively, the beneficial effect may be less important in general populations than in relatively poor American populations. We found no significant differences in the likelihood of hospitalization comparing the physician and the practice based continuity measures. This finding is not unexpected given the fact that most patients in B.C.’s large practices appear to affiliate with individual providers.

Project C — Continuity of Primary Care in Mental Health

Some of our program team’s previous research has shown that psychosocial conditions are a main driver behind physician (primary care and specialty) costs in B.C. Moreover, we have found that major psychosocial conditions are especially prevalent among high users of physician services. This project focused on continuity of care for a very vulnerable group with major psychosocial conditions: persons with severe and persistent mental health problems. Continuity of care is a main tenet in mental healthcare, and much research has revolved around trying to measure and enhance it. Most research has focused on continuity provided by specialized mental healthcare teams, and especially the links between acute care hospitalizations and community mental healthcare. Building on the work in Project A, we focused instead on continuity of primary care for this vulnerable group.

The aims of this project were to (a) assess continuity of primary care for B.C. patients with severe and persistent mental health disorders, including schizophrenia, major depression, and personality disorders; (b) assess interrelationships between continuity of primary care and patient factors; and (c) assess the relationship between primary care continuity and selected outcomes, including acute care hospitalization, readmission, and mortality. See the appendix for more details.

Methods: Our main challenge was to construct a cohort of people with severe and persistent mental health disorders, using available administrative data sources. We used five sources from within the B.C. Linked Health Database: fee for service physician payments; acute care hospital separation records; pharmaceutical payments from B.C.’s Pharmacare system; the Client/Patient Information Management database of B.C.’s community mental health system; and death data from B.C.’s Vital Statistics agency.
Creating continuity measures for this population was particularly challenging because of large data gaps around care provided to mental health patients. The physician claims database is missing encounters provided by salaried and sessional psychiatrists, who account for more than half of all provincial payments made to psychiatrists in B.C. As well, the physicians practicing at several inner city primary care clinics that serve many patients with severe mental illness are paid through alternative (non fee-for-service) arrangements. While the Client/Patient Information Management data contain a record for most cases opened by community mental health workers, they contain substantial gaps and provide no visit based information. Finally, the Pharmacare data are not population based — the Pharmacare program provided, at the time of analysis, comprehensive first dollar coverage for certain eligible populations only.

Our task was to use this range of data to (a) identify a cohort who we were reasonably certain had severe and persistent mental health problems; and (b) apply the continuity of care measures constructed in Projects A and B. In the end, the data challenges trumped the continuity analysis, so much of what we have to report bears on the complexity of using administrative data (at least as available in B.C.) for analyses of this type of patient population. We offer some thoughts, as well, on concrete steps that might be taken to improve the comprehensiveness of these data, and ways to make the most of what is available.

Because no single source of data provided a means for us to identify the population of interest, we combined four databases (physician payments, hospital separations, pharmacy payments, and Client/Patient Information Management data) to identify persons who we were reasonably certain had severe and persistent mental health problems. We first identified all people who had mental health diagnoses (from the physician or hospital records), received a drug used to treat mental health conditions, and/or made contact with the community mental healthcare system. We then further restricted our inclusion criteria by limiting the range of diagnoses used and requiring multiple diagnosis occurrences (to eliminate “rule out” diagnoses). Finally, we applied these criteria across multiple years to identify persons with severe and persistent conditions. Once the cohort was identified, we attempted to calculate the UPC and COC measures using the methods developed in Projects A and B. However, because of the data gaps in the physician payment data, we substituted pharmacy for physician data and calculated the concentration of prescriptions written by different providers. Because the Pharmacare data are not population based, we included only those people eligible for first dollar coverage through one of four Pharmacare plans: seniors aged 65 and older; persons living in residential care facilities; persons on income assistance; and clients of the mental health system (not otherwise covered).

Because this is the first study (to our knowledge) that has attempted to measure continuity of physician care using prescription based measures, we also undertook a small sub study to examine the validity of this approach. For a random five percent sample of B.C. seniors, we compared continuity measures
constructed with physician and pharmaceutical claims, for whom both databases are reasonably complete. The distributions of the measures were compared and the agreement assessed with kappa statistics. We then went on to construct the pharmacy based continuity measures for the mental health cohort.

Our three outcome variables — hospitalization (yes/no), number of hospitalizations, and mortality — were measured with the linked hospital separations and death data in the year following continuity measurement. In addition to examining the bi variate relationships between patient variables and continuity, we also constructed case mix adjusted regression models for each outcome variable and each Pharmacare plan.

**Results:** Approximately 600,000 persons with mental health conditions were identified in one or more of the four databases during 1997/98. Using our more restrictive inclusion criteria narrowed this to about 26,584 persons who we were reasonably confident had severe and persistent mental health conditions. Most of these persons were not identified with the physician claims, likely reflecting the data gaps mentioned above. About 70 percent were identified with pharmaceutical and/or Client/Patient Information Management data alone. The final study cohort of 23,792 included only persons covered under one of the four relevant Pharmacare programs and who had three or more relevant prescriptions during the study period.

In the small sample sub study on a population for which we had both physician payment and pharmaceutical payment data, agreement between the continuity measures constructed with physician payment data and those calculated with Pharmacare payment data was low (for example, the kappa statistics between the physician claim and Pharmacare claim COC measures was only 0.48). Overall, our validation sub study showed that there was quite poor agreement between the two types of measures. The pharmaceutical measures appeared inflated and showed less variability.

When we applied the pharmacy based measures to the mental health cohort, we found that the measures revealed much better primary care continuity than what we expected in this population. The COC was much higher for the mental health cohort than for general practice populations in Project B. This likely relates to the poor (inflated) performance of the pharmaceutical based measures noted above. Seniors and persons in residential care with severe mental health concerns had higher continuity than those on income assistance.

Overall the multivariate regression models performed very poorly in predicting hospitalization in the following year. This likely relates to either missing variables or incomplete model specification. We found that the continuity measures were statistically significant in only one population: mentally ill persons on income assistance (odds ratio=0.76 comparing high continuity with low continuity). The
multivariate models performed much better in predicting death in the subsequent period, but continuity was not found to be predictive of death in any of the models.

Interpretation: We encountered many unanticipated difficulties in this project that, in the end, severely hampered our ability to examine the effects of continuity among mental health patients. Most related to significant gaps in the administrative data for physician services which fall outside the fee for service system, the unavailability of population-based pharmacy data, and the significant data holes that exist in the community mental health data. These gaps not only hampered our ability to identify a population based cohort with severe and persistent problems but also to measure continuity in primary care settings.

Because of the holes in the physician data, we tried to use pharmaceutical data in their place and limit the analyses to those covered under one of B.C.’s Pharmacare plans. However, a small sub study on a sample of B.C. seniors (for whom we could construct both types of measures) revealed poor performance of pharmacy based measures. Not only were they inflated, but also they showed poor agreement with the physician based measures.

Despite the problems with these measures, we did find that continuity of primary care was predictive of hospitalization in the next year for severely mentally ill persons on income assistance; the case mix adjusted odds of hospitalization was 0.76 when persons with high continuity are compared to low continuity. However, the models overall performed poorly.

Our work on this project suggests that primary care continuity may, indeed, be important for patients with mental health problems, but that considerably more work will need to be done, either to create more comprehensive data sources, or to develop alternative ways of ascertaining continuity from the data that are available. To date, most research has revolved around linking patients with community mental healthcare without considering the primary care delivered to those patients. Given how frequently these patients seek primary care services, it is not implausible that seeing the same provider consistently would result in improved care plans and less hospitalization.

Project D — Continuity of Primary Care in Persons with Workplace Injuries

A major finding of work conducted at the Centre for Health Services and Policy Research and the Workers’ Compensation Board of B.C. prior to the commencement of this project was that the healthcare utilization of individuals who make claims to the Workers’ Compensation Board is higher than that of age and sex matched individuals who do not make claims. This difference is present even prior to the first Workers’ Compensation Board claim, suggesting that the workplace injury is not the only, and is perhaps not the most important, predictor of the use of healthcare services post injury. This project was intended
to further investigate these initial findings using the results of Project A. In particular, we were interested in exploring patterns of continuity of care in the period prior to injury, and whether continuity in the post injury period had any effect on the length of time between injury and return to work.

There is potential benefit in understanding the relationship between workplace injuries and continuity of care both prior to and following a reported injury. An association prior to report of injury might suggest that there could be preventive strategies put in place either to change the probability of experiencing an injury or to minimize the impact of an injury. It is perhaps easiest to see this potential connection for chronic conditions, where early identification and treatment of a potential problem (minor wrist pain) could reduce the likelihood of a full blown outcome (a lost time claim for carpal tunnel syndrome).

Continuity of care may be even more important following an injury, if for example, high continuity of care can influence the time required for rehabilitation and the time until return to work. Depending on the nature of the injury, continuity as represented by a co-ordination of care among several different providers may have a significant potential impact on these outcomes.

Whether prevention or rehabilitation is of interest, to date the effects of continuity of care on injury and return to work profiles have been assumed rather than tested. The purpose of Project D was to provide an initial test of these assumptions and some descriptive information about the experience of injured workers and continuity of care, both before and after their reports of injury.

Methods: This project used the B.C. Linked Health Database data on fee for service physician payments linked to Workers’ Compensation Board of B.C. injury claims and duration of injury. The Workers’ Compensation Board cohort included all individuals who reported to the board a work related injury that occurred in 1999. For duration of injury, the cohort was restricted to individuals whose injury was deemed compensable by the board and that resulted in at least one workday missed.

A comparison group was constructed by one to one matching of the Workers’ Compensation Board cohort to the general B.C. population based on age, sex, and region of residence, excluding all individuals who reported a work place injury at any time from 1987 through 2000. Region of residence was used as a proxy for occupation, as no occupational information was available for the comparison group, and types of employment, and thus rates of workplace injury, are known to vary by region. The cohort and their matches were linked to each other to enable analyses of restricted samples, such as people who made a first-ever workplace injury report to the board during 1999.
Continuity measures were constructed according to the methodology developed in Project A. Average continuity scores in the two years prior to injury and two years following injury were calculated for age and sex groups, categorized by number of GP visits and by duration of injury.

Results: There were 141,001 individuals who reported a workplace injury to the B.C. Workers’ Compensation Board in 1999. More than two thirds of the claimants (71 percent) were male and more than half (56 percent) were between the ages of 25 and 44. This is consistent with previous descriptions of injured workers as young, male, and often new to their jobs.

Nearly three out of every four workers (73 percent) who reported a work related injury in 1999 had a previous injury claim to the B.C. board during the years 1987 through 1998. Considering only those workers with previous claims, about a quarter (27 percent) reported one previous injury, nearly half (48 percent) between two and five, and the remainder (25 percent) more than five.

About 40 percent of all reported injuries result in time off work that the Workers’ Compensation Board adjudicates and accepts as resulting from an occupational injury. Of these, one in eight is off work for one day or less; more than two thirds are off for less than a month. The converse of this is that more than 18,000 workers in B.C. in 1999 had work related injuries serious enough to keep them away from their jobs for more than a month.

Continuity of care was slightly but consistently lower for the Workers’ Compensation Board cohort compared to the comparison group in both the time prior to injury and the two years following injury (see appendix for corresponding tables). There is no clear pattern looking at continuity of care and duration of injury.

Interpretation: The results here are consistent with earlier work that showed that individuals who report workplace injuries have patterns of healthcare service use that are different from a matched comparison group. In this case, these injured workers experience lower levels of continuity, both before and after their workplace injury. Limiting the cohort to people who made their first injury report in 1999 did not change this pattern.

This is a very preliminary finding, but its consistency with previous work suggesting that injured workers are somehow different from a matched comparison group is intriguing. The experience of lower average continuity among the Workers’ Compensation Board injury cohort suggests there may be room for modifying patterns of primary care service use, and thereby changing either the propensity for or the results of workplace injury. Further research in this area will be of interest to workers’ compensation boards because they have the ability to make and implement policy in this area.
Implications

This program of research has produced a number of interesting insights, some data related, some methodological, some directly policy relevant, and some on the process of working with policy program decision makers.

Implications for the Use of Administrative Data

We found acceptable concordance between a survey based source of information on a regular source of care and our measures of continuity of care that were based on administrative data. There is no gold standard here, but unlike asking survey respondents to recall particular healthcare episodes or contact details, it seems reasonable to suggest that individuals will have a good sense of whether they have a regular physician. We interpret the consistency between the survey based information and our measures as supporting the use of administrative data for the purposes of measuring continuity in primary care settings.

The obvious exception to this general story relates to administrative data for mental health patients. While we cannot say anything about the generalizability of our results to other jurisdictions, in Canada or elsewhere, it is obvious from the amount of time and energy expended on Project C that the administrative data available in B.C. are inadequate for continuity of primary care research on this patient population.

Finally, it is worth noting that any primary care reform that has the side effect of eliminating data detail (such as individual physician encounter information) will hamper or make impossible future research on continuity of care using administrative data.

Implications for Research Methods

This program of research involved arguably the most comprehensive analysis (of which we are aware) of alternative approaches to measuring continuity of primary care using administrative data. The work revealed relatively high agreement for four of the measures analyzed here — UPC, COC, K, and SECON — and less agreement with two others — LICON and LISECON. On the basis of the characteristics of the various measures, we concluded that the UPC or K index may be preferred by policy makers because these measures are easy to calculate, require minimal data, and are easily interpretable. For researchers, the UPC or the COC may be preferred because their common use makes comparison of results across research studies possible.
A second important implication emerging from our work was that, because of the very nature of continuity of care, longer periods than one year are desirable if robust measures are to be generated for research and policy purposes.

The third key implication for research methods is that more work will be necessary if we are ever to be able to develop reliable and useful continuity of primary care measures for the mental health population. This may mean constructing entirely new measures, or being more creative in adapting the existing measures to the available data.

**Implications for Policy and Programs**

A number of applied implications emerge from this research. An obvious place to start would be with the observation of higher continuity for patients whose care is provided through group practices than from single practitioners. This observation, combined with the finding that the vast majority of provincial patients do not receive care through large groups, suggests that there will be considerable challenges for primary care reform (the underlying philosophy for which is largely supported by the findings here) in this province. On the flip side, the observation that many patients who receive care from group practices receive the majority of that care from a single physician, suggests that there is considerable scope for more comprehensive integration of care.

We do not believe that we are in a position to draw any policy/program implications from our extensive work with the mental health cohort, given the considerable data problems encountered. However, a tentative implication might be that more attention needs to be given to the traditional primary care of this population, since much of the focus appears to have been on their use of community mental health services and their hospitalization experiences.

Finally, the key implication of the work on injured workers would seem to be that hospitalizations, time away from work, and injury rates may all be reducible through programmatic approaches to improved continuity of care for workers at high risk of workplace injury.

**Implications for Future Collaborations with Policy & Program Personnel**

Our experience in this program of research has been mixed, with respect to collaboration with our decision making partners. We offer a number of observations in this respect. First, in retrospect this program may not have been particularly appropriate for decision making partners, though we could not
have known this at the outset. It turned out that much more effort than we had anticipated, or wished, went into data set construction and methods development. Our mental health project decision making partners were essential in this work, but others had (understandably) little interest in this aspect of the work.

Second, programs of research are, by their very nature, long-term undertakings. Policy makers and programmers tend to have shorter timeframes. They also tend to experience much less ‘job stability’ than do researchers. Both of these characteristics make the nurturance of sustained collaborative research partnerships a challenge. We expect to engage in a variety of knowledge translation activities as a result of this work, but by and large that activity will involve different individuals from the decision making partner side than those with whom we began. In marked contrast, the research team that developed the original proposal is, by and large, still intact and working together.

**Further Research**

As with any comprehensive program of research of this nature, much was left ‘on the table.’ Without pretending to be exhaustive, we would suggest that the following are fruitful areas of further work:

- One of the key weaknesses of this program was that, with the exception of the Workers’ Compensation Board work (Project D), we limited our outcome measure to hospitalization in a period after the period that we used as the basis for computing the continuity measures. A number of other relevant outcomes would be worth looking at in relation to continuity of primary care, including avoidable hospitalizations, use of pharmaceuticals (including use of new drug products), use of specialists, and so on.

- More work is needed on the nature, extent, and implications of patients receiving primary care through group as compared with solo practices. For example, we were unable, within the time and resources at hand, to compare outcomes (such as future hospitalizations, drug use, etc.) for patients of large groups who get most of their care from a single physician within the group versus those who get care from a mix of physicians within the group. This would go some way to answering the question regarding whether, even within a group environment, it is still better to be seen by a single physician than by many. If so, does this relate to the extent of “information continuity” practiced within the group?
• Severely and persistently mentally ill patients are among the most vulnerable in our society. We continue to believe that improved primary care continuity for such patients would improve their quality of life and reduce their use of hospitals. However, much work needs to be done, both in data development and in methods development, if research is to be able to provide useful insights for program personnel in this area.

• Within the injured workers realm, our research would have benefited from a more refined approach to matching cases and controls. Also, using research to improve our understanding of possible barriers to continuity of care for high risk workers, given the potential benefits of improving continuity for that group, would seem to be a fruitful follow up to Project D.
References


